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ABSTRACT

This package, with one module on the microscope, is one of six such packages containing a total of 46 modules that comprise Health Occupations Education II, the second course of a two-year course of study. Each module may contain some or all of the following components: introduction, directions, objectives, a list of learning activities, student information sheets, student assignment sheets, student self-checklists, a description of check-out activities, an evaluator's final checklist to assess student performance, and a student self-check key. The title of the module is Care and Use of the Microscope. (YLB)

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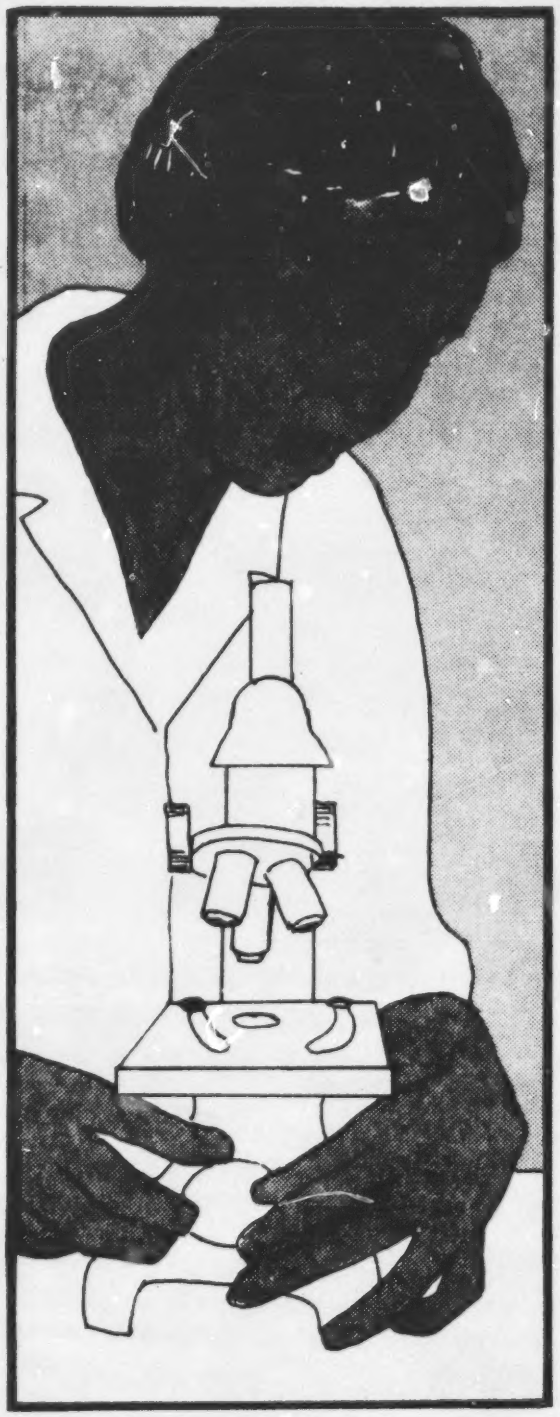
CARE AND USE OF THE MICROSCOPE



INTRODUCTION

Of all equipment in the clinical laboratory, the microscope receives the most use. It is a tool used in diagnosing disease. Microscopic work is a basic activity in the laboratory whether the laboratory is located in the hospital, physician's office, the health department, or a clinic. In this module you will learn the care and use of the microscope.

DIRECTIONS

In order to complete this module you will need:

1. Microscope
2. Clean slide
3. Slide cover
4. Newsprint or magazine
5. Drop of water
6. Scissors to cut newsprint
7. Lens paper or clean soft cloth

Read the Objective. If you think you are able to perform this task, read the Check-Out Activities. Then either arrange with your evaluator to do the Check-Out Activities,

or

If you need to complete learning activities in order to be able to perform this task, locate the section on Learning Activities and go through them in the order in which they are listed.

OBJECTIVE

Given a microscope, related equipment, and selected instructional exercises on the microscope, you will be able to identify the major parts of a microscope and their functions, to prepare a temporary slide, and to adjust the microscope to view the slide. Mastery will be determined by scoring a minimum of ___% on a teacher-prepared written examination.

LEARNING ACTIVITIES

1. READ Student Information Sheets Nos. 1-4.

2. VIEW Trainex filmstrip "The Microscope, Parts I and II,"

   and/or_____.

3. COMPLETE Student Assignment Sheet No. 1. Write the function of each part of the microscope which is listed.

4. LEARN to identify the parts of the microscope by using the diagram or the microscope (Student Information Sheet No. 2).

5. PREPARE a temporary slide using Student Assignment Sheet No. 2.

6. ADJUST the microscope using Student Assignment Sheet No. 3.

7. COMPLETE Student Self-Check. Record your answers on a separate sheet of paper.

8. ARRANGE with your evaluator to complete this module by going through the Check-Out Activities.

STUDENT INFORMATION SHEET NO. 1 – PARTS OF THE MICROSCOPE

The framework of the microscope consists of several units. The *base* is a firm, horseshoe-shaped foot on which the microscope rests. The *arm* is the structure which supports the magnifying and adjusting systems. The arm also is the handle by which the microscope can be carried without injury to the delicate parts. The *stage* is the horizontal platform or shelf on which the object being observed is placed. In some types of microscopes, a "mechanical stage" is added, making the manipulation of the object to be observed much easier.

Good microscopic work cannot be accomplished without proper illumination. The illumination system is, therefore, an important part of the compound microscope. The *mirror* is part of the illumination system. The mirror reflects upward the beam of light directed at it from the microscope light. The mirror has two sides; one is flat and the other concave. The concave side should be used for clinical work. In order to be certain that the mirror is at the correct angle, the ocular is removed and the light centered while the technician is looking through the body tube.

Another part of the illumination system is the *condenser.* This is used to focus the light from the mirror on the material under examination. The condenser is a conical lens system with the point planed off. It can be raised and lowered beneath the stage by means of an adjustment knob. By using the condenser properly, the image field is evenly lighted.

The third and last unit of the illumination system to be discussed in this section is the *iris diaphragm.* This diaphragm consists of a series of horizontally arranged interlocking plates with a central aperture. It can be opened or closed as necessary to adjust the intensity of the light by means of a lever. The size of the aperture, and consequently the amount of light permitted to pass, is regulated by the person using the microscope. The arrangement is similar to the diaphragm on most cameras.

The magnification system contains several important parts and plays an extremely important role in the use of the microscope. The *ocular* or *eyepiece* is a lens which magnifies the image formed by the objective. The usual magnification of the ocular is five times (5X) or ten times (10X). Other oculars, however, can be obtained with other magnifications. Most modern microscopes have only one ocular, and these are called *monocular* microscopes. The magnification produced by the ocular, when multiplied by the magnification produced by the objective, gives the total magnification of the subject being viewed.

The *objectives* are the major part of the magnification system. There are usually three objectives on each microscope. They are designated according to focal length: 16 mm, 4 mm, and 1.8 mm. The objectives are mounted on the nosepiece, which is a pivot, enabling a quick change of objectives. The 16-mm objective is the shortest one and is sometimes called the *low-power* objective. The 4-mm objective is often called the *high-power* objective. The 1.8-mm objective is the longest one and is called the *oil-immersion* objective. The distance from the bottom of the objective and the material being studied on the microscope stage is called the *working distance.* The working distance is very short for the 4-mm and 1.8-mm objectives, and for this reason correct focusing habits are necessary to prevent injuring the objectives against the slide on the stage. Often the term *parfocal* is used in speaking about a microscope. This term means that if one objective is in focus and a switch is made to the use of another objective, the focus will not be lost. The usual magnification of the 16-mm objective is 10X. For the 4-mm objective the usual magnification is 43X and for the 1.8-mm objective 97X. To obtain the total magnification for a microscope, the magnification of the objective is multiplied by the magnification of the ocular. Each type of microscope can have slightly different magnifications, depending on the ocular and the objective used. The actual magnification of an objective is inscribed directly on the outside of the objective itself.

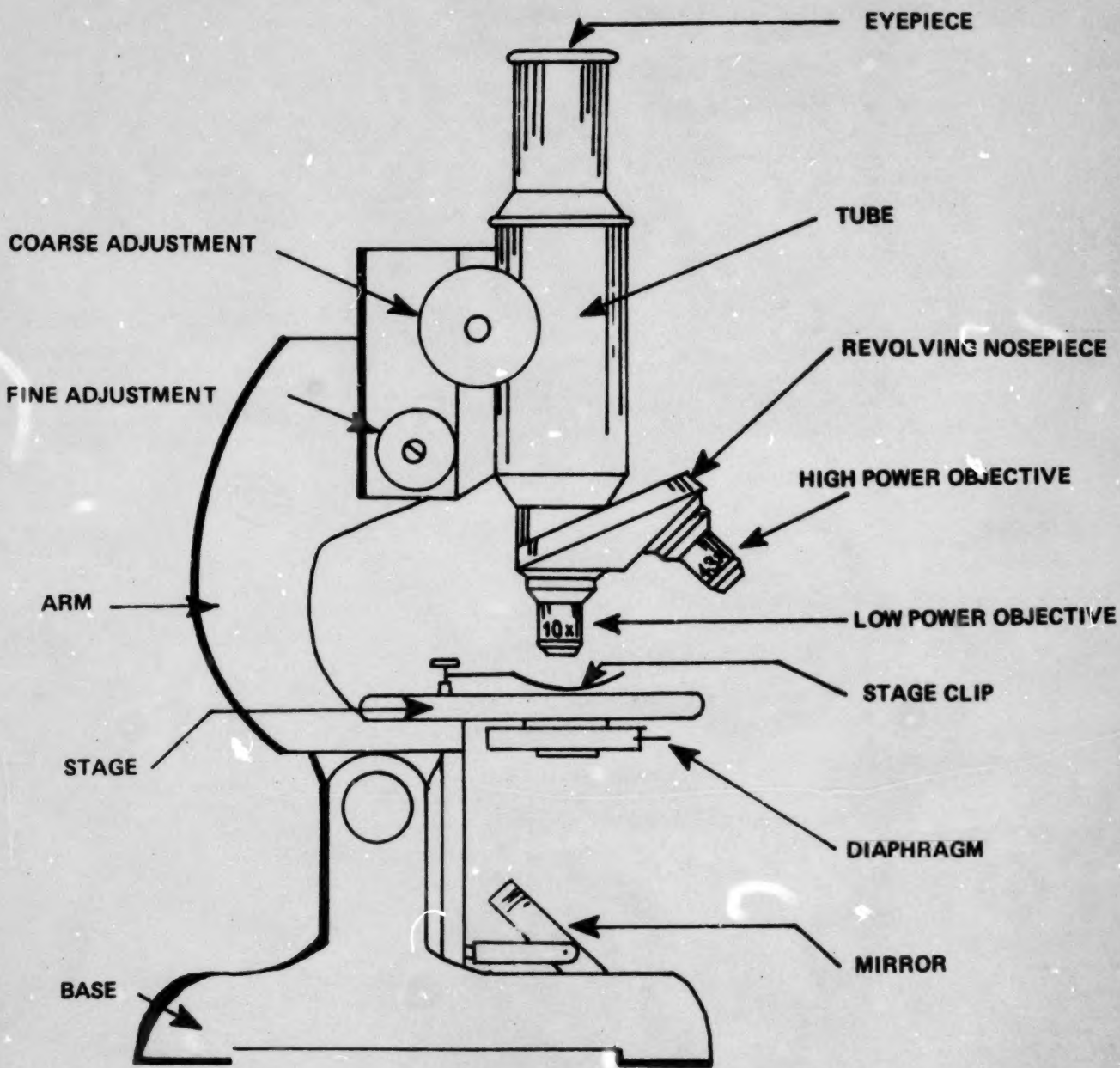
The *body* or *mechanical tube* is the part of the microscope through which the light passes to the ocular. This is the tube which actually conducts the image.

The adjustment system enables the body tube to move up or down for focusing the objectives. This system usually consists of two adjustments, one coarse and the other fine. The coarse adjustment gives rapid movement over a wide range and is used to obtain an approximate focus. The fine adjustment gives a very slow movement over a limited range and is used to obtain exact focus after prior coarse adjustment.

To understand thoroughly the intricate workings of the lens system of the microscope would require a much more detailed study than is deemed feasible at this stage in your training. Rather it is more important at this time to learn the mechanics in general and to understand how to use and care for the microscope properly.

ILLUSTRATION A

MONOCULAR MICROSCOPE



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STUDENT INFORMATION SHEET NO. 2 – CARE OF THE MICROSCOPE

The microscope is a precision instrument and must be handled with great care. When it is necessary to transport the microscope, it should always be carried with both hands; it should be carried by the arm and supported under the base with the other hand. When not is use, the microscope should be covered and put away in a microscope case, or in a desk or cupboard. It should be left with the low-power objective in place, the body tube barrel adjusted to the lowest position possible, and the condenser down.

The surface of most microscopes is finished with a black or gray enamel and metal plating which is resistant to most laboratory chemicals. These surfaces may be kept clean by washing with a neutral soap and water. To clean the metal and enamel surfaces of the microscope, a gauze should be moistened with the cleaning agent. Rubbing the surface with a circular motion will clean the enamel and metal. These should be dried immediately with a clean, dry piece of gauze. The mirror can also be cleaned in this manner. Gauze should *never* be used to clean any of the optical parts of the microscope.

The glass surfaces of the ocular, the objectives, and the condenser are hand-ground optical lenses. These lenses must be kept meticulously clean. Optical glass is softer than ordinary glass and should never be cleaned with paper tissue or gauze. These materials will scratch the lens. To clean the lenses of the microscope, use lens paper. If a lens is especially dirty, a small amount of xylol may be put on the lens paper. Xylol should be used sparingly, because it can damage the lens mounting if it is allowed to get beyond the front seal. The oil-immersion lens will require the use of a small amount of xylol on the lens paper in order to clean it properly. When xylol is used, the lens should be dried with a piece of lens paper. The lenses should never be touched with the fingers.

Dust can be removed from the lens of the ocular with a camel's hair brush. The oculars should not be removed for more than a few minutes as dust can collect in the tube and settle on the rear lens of an objective. At regular intervals the ocular can be checked for additional dirt by looking through it, using the microscope lamp for light. Dirt on any part of the ocular will rotate with the ocular when it is turned.

The stage of the microscope should be cleaned after each use by moistening a piece of gauze with a little xylol. After being cleaned thoroughly, the stage should be wiped dry.

The coarse and fine adjustments occasionally need attention. When there is unusual resistance to any manipulation of these knobs, force must not be used to overcome the resistance. Instead, the cause of the problem must be found first. A small drop of oil may be necessary. It is best to call in a repairmen specializing in microscopes when a serious problem occurs.

10

STUDENT INFORMATION SHEET NO. 3 – USE OF THE MICROSCOPE

Most microscopes utilize a lamp of some sort to assist in the illumination system. Some lamps are built into the microscope, and others are separate. The biggest concern in learning how to use a microscope for the first time is the lighting and fine adjustment maneuvers. One must be certain that the mirror, condenser, and diaphragm are in correct adjustment. Light adjustment is made before any focusing is done. The light adjustment is accomplished by raising and lowering the condenser and opening and closing the diaphragm. At the start of this initial lighting adjustment, the condenser should be all the way up and the diaphragm all the way open, with the low-power objective in place. While looking through the ocular, the diaphragm can be closed until the field is just beginning to be closed off. Next, the condenser should be lowered until the light is even.

The object to be examined is placed on the stage and secured. Usually the object to be observed is placed on a glass microscope slide. Care must be taken to avoid injury to the objectives while placing specimens on the stage. The barrel or tube of the microscope should be raised by means of the coarse-adjustment knob to prevent damage to the objectives.

Focusing is the next technique to be mastered. With the object on the stage and while watching from the side, the low-power objective is brought down as far as it will go, so that it almost meets the top of the specimen to be studied. The coarse adjustment is used for this procedure. The objective must not be in direct contact with the specimen. This must be watched from the side, as stated previously, to avoid damage to the objectives. Once the objective is just at the top of the specimen to be examined, the object is slowly focused upward using the coarse-adjustment knob, looking through the ocular while this is being done. When the object is nearly in focus, it is brought into clear focus by use of the fine-adjustment knob. When changing to another objective, the barrel distance must not be changed. As stated previously, most microscopes are parfocal. The only adjustment necessary should be that using the fine-adjustment knob. The fine adjustment is used continuously during the microscopic study.

If a greater magnification is needed, more light is necessary. Additional light is provided by use of immersion oil placed on the viewing slide when the oil-immersion lens (1.8-mm objective) is used. The oil directs the light rays to a finer point. When the oil-immersion lens is to be used, the desired area on the slide is first found by using the 10X (16-mm) objective. Once this area is located, the body tube is raised by using the coarse-adjustment knob, a drop of immersion oil is placed on the slide, and the oil-immersion lens is lowered into the oil while the technician looks from the side. The ocular should not be looked through during this adjustment procedure. When the initial adjustment has been made, the fine adjustment is made while looking through the ocular. The oil remaining on the lens of the objective after the study has been completed must be cleaned off using lens paper.

ILLUSTRATION B
THE MICROSCOPE – CARE AND USE

1

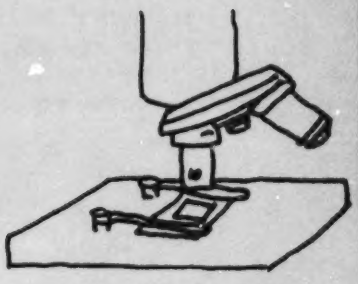
Comfortable position

2

Adjust light

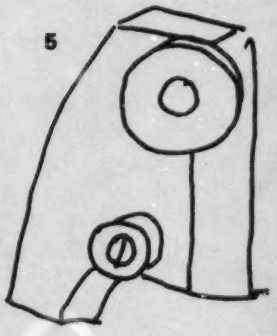
3

Position slide



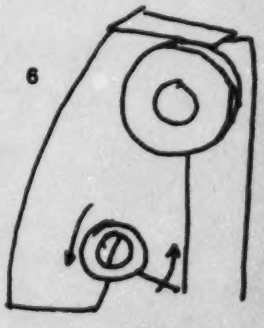
4

Rack down to 5mm from slide



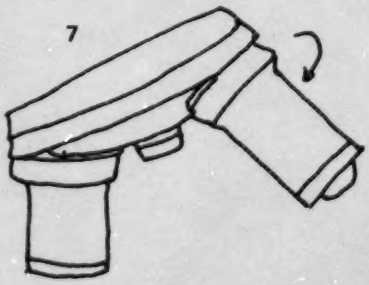
5

Focus by racking up with coarse adjustment



6

Sharpen image with fine adjustment



7

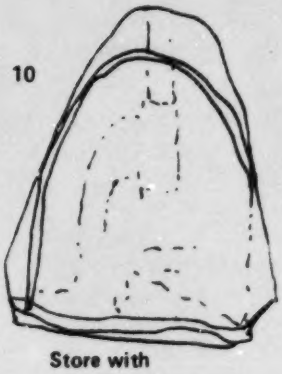
Change objective higher or lower

8

Keep lenses clean

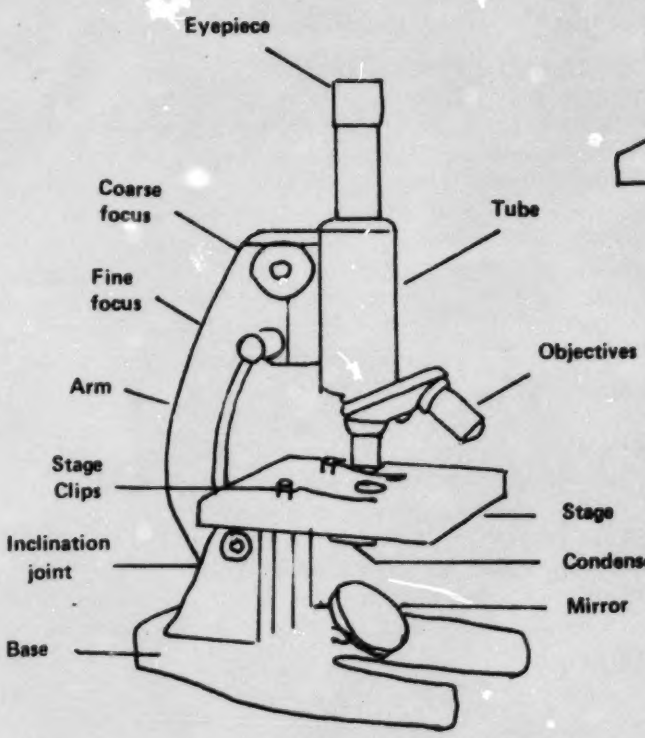
9

Carry properly



10

Store with cover in place



STUDENT INFORMATION SHEET NO. 4 – TYPES OF MICROSCOPES

There are other types of microscopes used for special procedures. The *compound microscope* is the one used in routine clinical observations and the one with which the health care worker should become most familiar. A *dark-field microscope* is one in which the light illuminating the object to be magnified is reflected rather than transmitted light. As a result, the object under study appears light against a dark background. Any compound microscope may be converted to a dark-field microscope by use of a special dark-field condenser in place of the usual condenser. The dark-field microscope is used to observe the spirochetes in the exudates from leptospiral or syphilitic infections.

Another type of microscope which is used in the laboratory is the *phase microscope*. The optical system of the phase microscope is such that materials with different densities appear to differ from each other in the intensity and the shade of the light transmitted through them. The need for staining is therefore eliminated. The phase microscope has found a use in the hematology laboratory in the direct counting of platelets.

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STUDENT ASSIGNMENT SHEET NO. 1 – PARTS OF THE MICROSCOPE

Write the function of each part.

PART	FUNCTION
EYEPIECE OR OCULAR	
REVOLVING NOSEPIECE	
LOW POWER OBJECTIVE	
HIGH POWER OBJECTIVE	
DIAPHRAGM	
STAGE	
STAGE CLIPS	
MIRROR	
TUBE OR BARREL	
ARM	
COURSE ADJUSTMENT	
FINE ADJUSTMENT	

STUDENT INFORMATION SHEET NO. 2 – TEMPORARY SLIDE

Prepare a temporary slide.

I. **Materials Needed**

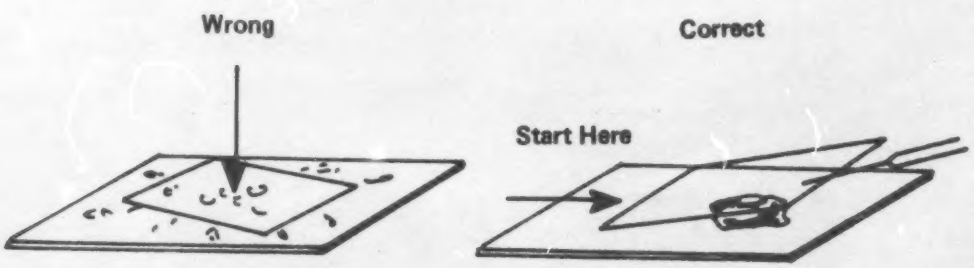
1. Blank slide and cover glass
2. Water and dropper
3. Small newsprint
4. Scissors

II. **Procedure**

1. Cut a single "e" from the smallest newsprint available.
2. Place the "e" right side up on the slide.
3. Add one drop of water on top of the "e."
4. Slide the cover glass at an angle from the left side of the slide until it touches the water, then gently lower it (Illustration C).

   Air trapped under the cover glass will interfere with what you see. Therefore, lower the glass slowly at an angle to push the air out the side.

ILLUSTRATION C



STUDENT ASSIGNMENT SHEET NO. 3 – PREPARATION AND ADJUSTMENT OF THE MICROSCOPE

I. **Tools and Materials Needed**

1. Microscope
2. Lens paper or clean soft cloth
3. Slide prepared from Student Assignment Sheet No. 1

II. **Procedure for Preparing the Microscope**

1. Carry the microscope with both hands, one hand under the base and the other on the arm.
2. Set the microscope in front of you with the arm toward you.
3. If necessary, clean the lenses with lens paper or a clean soft cloth.
4. Turn the low power objective into place. When it is in proper position, it will click.
5. Look through the eyepiece and turn the mirror toward a source of light.
   Never turn the mirror directly toward the sun.
6. Adjust the mirror until a uniform circle of shadowless light appears.

III. **Procedure for Adjusting the Microscope**

1. Place the slide you prepared from Student Assignment Sheet No. 1 over the hole in the stage with the letter in the center of the opening.
2. Use the two stage clips to keep the slide from moving.
   Since you are using a wet mount, do not tilt the arm of the microscope.
3. Looking at the low power objective *from the side,* turn the coarse-adjustment knob to lower the objective as low as possible.
4. Look into the eyepiece and slowly turn the coarse adjustment to raise the tube until the "e" comes into focus.
   Always focus with the coarse adjustment knob by *raising* the body tube.
5. Finish focusing by turning the fine adjustment.
   As you examine the letter, turn the fine adjustment slowly back and forth not more than one half of a turn. This brings out the details at different levels of the object.

Observations

1. In what way has the microscope changed the position of the letter?
2. In Circle A, make a drawing of the letter "e" as it appeared before you placed it under the microscope.
3. In Circle B, make a drawing of the "e" as it appeared under the microscope.
   Write the magnification of the letter next to the drawing.

4. Raise the tube slightly, then turn the objectives to the high power and focus with the fine adjustment only.

5. In Circle C, make a drawing of the "e" as it appears now.
Again, write the magnification of the letter.

ILLUSTRATION D

Circle A **Circle B** **Circle C**

6. While looking through the eyepiece, push the slide away from you. How is the letter moved in the field?

7. Push the slide to the left. How is the position of the letter changed in the field?

8. Can you see as much of the letter under high power as under low power?

9. Adjust the diaphragm. How does this affect what you see?

IV. **Procedure for Cleaning Up**

1. Clean and dry the slides.

2. Clean and dry the stage.

3. Clean the lens with lens paper.

4. Return the objective to low power.

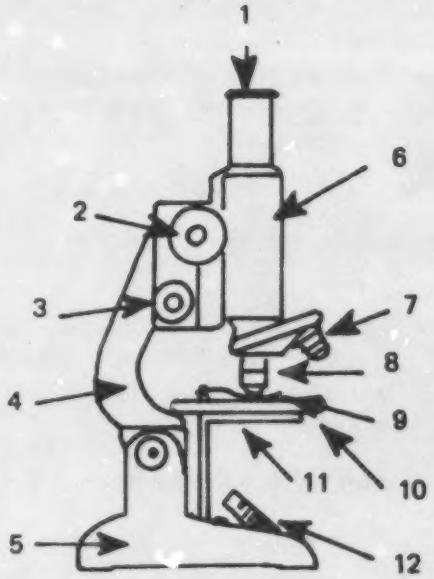
5. Turn the tube down near the stage, using coarse adjustment.

6. Cover the microscope.

7. Hold the microscope with both hands when returning it to its proper location.

STUDENT SELF-CHECK

1. Identify the parts of a microscope by writing the correct term next to the correct number.



Arm

Base

Body tube

Coarse adjustment knob

Diaphragm

Eyepiece

Fine-adjustment knob

High-power objective lenses

Low-power objective lenses

Mirror

Stage

Stage clips

2. List four steps in the use and care of the microscope.

CHECK-OUT ACTIVITIES

The statements below explain the activities you must be able to complete in order to finsih this module. After you go through the activities, your evaluator will rate your performance using the Evaluator's Final Checklist, CARE AND USE OF THE MICROSCOPE.

You will be given an examination on the care and use of the microscope. You will score a minimum of ___ % on the teacher-prepared written examination.

You will be given a microscope slide and other necessary equipment and supplies. You will perform a demonstration on the care and use of the microscope according to the following standards.

1. Identify parts of the microscope.
2. Describe the function of each part.
3. Prepare a temporary slide.
4. Adjust the microscope to view the slide.

Student _____

Date _____

CARE AND USE OF THE MICROSCOPE

Evaluator's Final Checklist

Check the student's performance in the following elements of the care and use of the microscope.

Place an X in the appropriate box indicating Not Accomplished, Partially Accomplished, or Fully Accomplished. If, because of special circumstances, the item was impossible to complete, place an X in the Not Applicable box.

Performance Level: All items must receive a rating of FULLY ACCOMPLISHED (or Not Applicable). If any items are rated Not Accomplished or Partially Accomplished, the student and evaluator will discuss this and decide which learning activities must be repeated.

	Student Performance			
	Not Applicable	Not Accomplished	Partially Accomplished	Fully Accomplished
When performing a demonstration on the care and use of the microscope, the student:				
1. Identified parts of the micrscope.	[ ]	[ ]	[ ]	[ ]
2. Described the function of each part.	[ ]	[ ]	[ ]	[ ]
3. Prepared a temporary slide.	[ ]	[ ]	[ ]	[ ]
4. Adjusted the microscope to view the slide.	[ ]	[ ]	[ ]	[ ]
Student scored ____% on a teacher-prepared written examination.	[ ]	[ ]	[ ]	[ ]

20

STUDENT SELF-CHECK KEY

1. Diagram

    1. Eyepiece
    2. Coarse-adjustment knob
    3. Fine-adjustment knob
    4. Arm
    5. Base
    6. Body tube
    7. Low-power objective lens
    8. High-power objective lens
    9. Stage clips
    10. Stage
    11. Diaphragm
    12. Mirror

2. Answers may vary.

    A. Adust light.

    B. Focus upward with coarse adjustment.

    C. Sharpen image with fine adjustment.

    D. Keep lens clean.

    E. Carry properly.

    F. Store with cover in place.